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On the Sign of a Determinant's Term.

BY ELLERY W. DAVIS.

Let k denote the row number and l the column number of an element (kl) in a determinant.

If in the determinant we interchange the k^{th} and p^{th} rows, then in the new determinant the elements that were called (kl) and (pq) in the old should be called (pl) and (kq). All other elements in any term to which (kl) and (pl) belong would remain unchanged in place and therefore in name.

Establish now a one-to-one correspondence between the elements (k, l) and the tracts of the lines $x/k + y/k = 1$ that lie between the axes of coordinates. Call the tracts (k, l).

Then I say that the sign of a term of the determinant is positive or negative according as these tracts cross one another an even or an odd number of times.

That it is so for the term given by the principal diagonal is plain. It remains to show that interchanging two rows of the determinant will alter the parity of the number of crossings.

Let (k, l) cross (p, q) and interchange the k^{th} and p^{th} rows, getting (p, l) and (k, q). On drawing a simple diagram, it will become plain that:

i. (p, l) will not cross (k, q).

ii. Any tract crossed by (k, l) but not by (p, q) will be crossed by (p, l) but not by (k, q), and that likewise any tract crossed by (p, q) but not by (k, l) will be crossed by (k, q) but not by (p, l).

iii. Any tract crossed by both (k, l) and (p, q), or by neither (k, l) nor (p, q), will be crossed by both or neither of the tracts (p, l) and (k, q).

Now ii. does not change the number of crossings, iii. does not change the parity of the number, i. does change the parity. Therefore, upon the whole, the parity is changed and our theorem is proved.